LCAC versus LCU: Are LCAC Worth the Expenditure?
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EXECUTIVE SUMMARY

Title: LCAC versus LCU: Are the LCAC Worth the Expenditure?

Author: LCDR K. L. Schmitz, United States Navy

Thesis: With the current emphasis on reducing defense budgets and a smaller military force improved through enhancements and selected modernizations, perhaps the Department of the Navy should pursue Landing Craft Air Cushion (LCAC) vehicle retirement and Landing Craft Utility (LCU) enhancement.

Discussion: In 1992, the Department of the Navy shifted its strategic focus away from a global threat to the challenges and opportunities posed by regional events. The new strategy emphasized power projection and employment of naval forces from the sea into the littoral regions of the world. It was later updated to expand the role of naval forces further across the spectrum of conflict to include peacetime operations, crisis response, and regional conflicts. This expansion coincided with an era of declining defense budgets resulting in a smaller, restructured force frilly prepared for the challenges of the new era. The concepts of stealth, mobility, and over-the-horizon warfare transitioned from the era of "blue-water" naval warfare to a new era of "brown-water" naval warfare. Additionally, the Marine Corps warfighting philosophy of maneuver warfare now emphasizes those concepts in "Operational Maneuver From the Sea (OMFTS)" and "ship-to-objective" maneuver, but at what cost?

The traditional ship-to-shore maneuver with conventional landing craft has served as doctrine for naval expeditionary forces for over 50 years. With today's emphasis on doing more with less, can the naval services continue to afford the high costs of mobility assets such as the LCAC? Is it time to consider LCAC retirement and perhaps enhancement of conventional landing craft, such as the LCU? The type of operations that naval forces can expect to conduct in the future are in the low to mid-intensity levels of the spectrum of conflict. These operations, which include peacekeeping, humanitarian assistance, and crisis response, do not necessarily require the stealth, mobility, and over-the-horizon capabilities provided by the LCAC.

Arguments for retiring the LCAC primarily center on LCAC annual cost versus capabilities. The planned fleet of 90 LCAC will cost the naval services an estimated $90 million annually, while the current fleet of 34 LCU will cost an estimated $850 thousand annually. Retirement of the LCAC could mean an annual savings of $89 million. Associated to the cost of the craft is lift capacity. It takes $3 million in annual LCAC costs to equal the lift capacity of one $25 thousand LCU. If the capabilities of the LCAC are not as critical for future missions, is the cost of the LCAC justifiable in this era of declining defense budgets?

Arguments for maintaining the LCAC inventory include its speed, mobility, over-the-horizon capability, and its accessibility to nearly 80 percent of the world's beaches. The conventional landing craft, such as the LCU, can access only 20 percent of the world's beaches. Additionally, the LCAC does not have to stop at the beach like conventional craft; it can maneuver inland to the objective area. It is an essential lift asset within the scheme of OMFTS.

Conclusion: The LCAC lift capacity, speed, and maneuverability provides greater flexibility to the Marine-Air-Ground Task Force (MAGTF) punch. It will keep the MAGTF at the center of the military's power projection mission well into the next century. Both the LCAC and LCU have served the naval forces well and each has plenty to contribute to future operations. The investment in LCAC has been made; they have proven their value to the naval expeditionary forces. Despite heavy maintenance and operating costs, now is not the time to consider LCAC retirement.

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LCAC versus LCU: Are LCAC Worth the Expenditure?

"The history of warfare shows that the basic strategic asset of sea-based peoples is amphibious flexibility. In tackling land-based opponents, they can produce a distraction to the enemy's power of concentration that is advantageously disproportionate to the scale of force they employ and the resources they possess."[1]

In 1992, the Department of the Navy, shifted its strategy from a focus on a global threat to a strategy focusing on regional challenges and opportunities. The strategy "...From the Sea" moved the naval services away from operations on the sea toward power projection and employment of naval forces from the sea to influence events in the littoral regions of the world -- those areas adjacent to the oceans and seas that are within direct control of and vulnerable to the striking power of sea-based forces.[2] Two years later, the strategy was updated and expanded addressing specifically the unique contributions of naval expeditionary forces in peacetime operations, in responding to crises, and in regional conflicts. This latest strategy, "FORWARD …From the Sea", incorporates not only a larger field of operations across the spectrum of conflict, it emphasizes conducting missions around the globe with a smaller, restructured force improved though enhancements and selected modernizations -- a force fully prepared for the challenges of a new era. The importance of this new emphasis becomes clear when looking at the terrain of many littoral countries. With few roads, usually of poor quality, a sea borne force is often more mobile than a land force. Here the amphibious capability of our naval forces and the sea borne mobility they provide are well suited to the tasking. It can shift its main focus faster than the defense ashore can react, providing an operational mobility.[3] Additionally, as today's weapons increase in killing power, the urgency to move troops into areas of conflict with more speed and stealth is increased. The means to ferry troops ashore, or maneuver them once

deployed, may prove critical to mission success.[4]

The scope of this paper is to conduct an analytical study of the capabilitites, employment, and costs of the Landing Craft Air Cushioned (LCAC) vehicle and the Landing Craft Utility (LCU). With today's emphasis on a smaller force improved through enhancements and selected modernization, the focus of analysis will center on answering the question -- Should the Department of the Navy pursue LCAC "retirement" and LCU enhancment? In order to make that determination, it is necessary to examine the capabilities each craft brings to today's naval forces and the future enhancements being considered. The study will conclude by examining some of the reasons why LCAC retirement could be considered.

Concept of Operations

The amphibious operation has historically been the most difficult of all military operations to execute. It may even be more so today. The traditional technique of conducting amphibious landings into the teeth of the enemy strength during daylight is being superseded, mandated by the mismatch between reduced sea-based fire support and the standoff defenses of potential foes. The emphasis has shifted from massive daylight assaults against heavily defended beaches to stealth, speed, and nighttime launches. The concept is to land where the enemy isn't; hit facilities and accesses critical to reaching the designated assault area; quickly build up combat power ashore; seize key inland targets; and after repulsing or avoiding the expected counterattack, press on with the mission. With mobility and surprise an expeditionary force can succeed where it otherwise might have failed with massed troops and a costly frontal assault.[5]

In the past, maneuver-at-sea was separated from maneuver-on-land by a slower ship-to-shore movement conducted by the landing force, in essence producing a seam on the battlefield.

Future maritime power projection ashore will be a continuous maneuver from the rearward naval base of embarkation to the ultimate objective, without stopping at the shoreline to regroup.[6] Using the Marine Corps employment concept "Operational Maneuver From the Sea (OMFTS)," the final approach to the objective -- a previously unheard of distance of as much as 200 nautical miles -- may be accomplished under the cover of darkness.[7] Marine-Air-Ground Task Force (MAGTF) elements will launch from far out at sea and be transported to widely dispersed locations. This will make it much easier to achieve surprise, avoid the threat of sea mines, and confuse the enemy. To fully exploit the LCAC mobility, the Commander, Amphibious Task Force (CATF) and Commander, Landing Force (CLF) will need to plan for landing at one of several locations, possibly deferring the final decision on the penetration point(s) until after the landing force is well on its way toward the shore. This process demands accurate, timely intelligence about the location and movement of enemy units at several potential landing sites, as well as information on the beaches themselves. At the same time, naval forces will retain maximum flexibility for the insertion of subsequent waves -- the landing force will not be committed to a single beachhead or landing zone. Finally, there will not necessarily be a requirement to quickly seize ports or airfields to accommodate follow-on forces, thus allowing the landing force to avoid dangerous urban areas.[8] Maneuvering from ship and crossing the shoreline to the objective without stopping will result in an overall seamless maneuver by the expeditionary force.

What capabilities do the LCAC and LCU bring to today's amphibious forces?

LCAC Capabilities and Limitations: The LCAC, one leg of the OMFTS triad, gives the naval forces many of the capabilities needed for the current concept of amphibious operations. First, LCAC provides a four fold increase in both speed and percentage of beaches worldwide available for landing forces. Owing to its speed and range, the LCAC can be launched from over the horizon (OTH) and can reach the beach in roughly the same time a conventional landing craft can traverse the standard 3,000-6,000 yard boat lane. Because the LCAC permits the Amphibious Task Force (ATF) to remain further offshore, it also reduces the mine threat to the ATF, though the LCAC itself, like conventional craft, may be susceptible to bottom influence mines in the surf zone and antitank mines on the beach. In addition, the OTH capability allows the ATF to remain clear of shore defenses and reduces risk of shore-based surface missile systems (SSMs). With its ability to ride on a cushion of air, the LCAC can touch down on beaches that are unapproachable by conventional displacement-hulled craft, such as the LCU. Second, LCAC is capable of transitioning inland beyond the shoreline. Ashore it can maneuver to a secure, dry landing zone, rapidly off load, and quickly return to its support ship for follow on serials. Third, LCAC provides the ability to hit more targets and build up combat power ashore faster. Fourth, the use of LCAC can force the enemy to disperse forces or commit more of them to coastal defense. And finally, LCAC allows expeditionary forces to operate within the reaction cycle of the enemy -- act faster and more decisively than the enemy forces, upsetting their balance.

LCAC Operations: A key to LCAC is not only its speed, but the ease with which it can be loaded. The amphibious lift ship does not have to ballast or deballast to embark LCAC. This allows loads to be staged in the well deck between LCAC runs. Because of its drive-through

capability -- the LCAC has bow and stern ramps, allowing several craft to be loaded simultaneously -- two LCAC can be quickly reloaded and launched in the time it takes to ballast and deballast for one LCU. Another benefit of LCAC is its ability to be refueled while the craft are being reloaded.

LCAC operations are far less labor-intensive and tactically restrictive for the support ship. LCAC are easily launched and recovered under way in open seas up to seastate three -- an average wave height of five feet -- allowing the ship freedom to maneuver. The Condition 1-A watchbill for LCAC operations is far more manageable than the one for receiving conventional landing craft. Launching or recovering displacement-hulled craft require more than 30 line-handlers and petty officers; several LCAC can be handled by a well deck control officer, a well deck safety observer/officer in charge, and one or two ramp marshalls who actually direct the LCAC in and out of the proper spots in the well.[9] Because the LCAC can make a rapid turn-around after a run to the beach, the personnel savings gained from not having to provide linehandlers provides the sizeable deck force needed to direct vehicles and handle cargo, exploiting the LCAC speed. Additionally, the similarity between LCAC and helicopter operations provides the naval forces an added bonus. Conducting simultaneous flight and welldeck operations is remarkably easy, and the flexibility and speed of offload using helicopters and LCAC is a great benefit.[10]

For a notional Marine Expeditionary Unit (MEU) with five tanks and one battery of six howitzers, four LCAC would be sufficient to move all the tanks and artillery to the beach, each LCAC completing two round trips between ship and shore -- approximately 2 hours total elapsed time. Only 15 LCACs would be required to land the MEF(FWD)'s 17 tanks and three artillery

batteries with their prime movers, assuming a fourth artillery battery is taken ashore by helicopter.[11]

Operationally, LCAC are not used in assault waves because of extreme vulnerability to shore defenses. Lightly armored, the LCAC presents a large radar, visual, and infared target, and will be particularly vulnerable as it slows to traverse the shoreline and stops to debark troops and cargo. The same is true for the LCU, but the LCAC has a significant degree of redundancy in its construction. It was designed to operate on cushion, even with a significant amount of damage to its rubber skirt and the loss of much of its propulsion plant. Its survivability lies in its ability to hit a wide range of beaches at high speed with little warning.[12] Although no more vulnerable than conventional landing craft, and able to operate with significant damage before being put out of commission, its value requires that LCAC cushion landing zones (CLZs) be secured before the vehicle crosses the beach.

A frequent criticism is the LCAC small payload of 60 tons. However, the LCAC speed and turn-around time between runs to the beach diminish any such criticism. The criticism against the LCAC because of its inability to carry large numbers of combat troops will be nulllified with the recent development and testing of the Personnel Transport Module (PTM).

Facts, capabilities and criticisms aside, how has the LCAC been evaluated by on-scene commanders? Since 1990, the LCAC has firmly established its place in Marine expeditionary operations and opened the door for the use of the craft as part of a mobile riverine force. Although capability, vulnerability, and maintainability of LCAC were seriously questioned in its early days, its performance in Desert Shield, Desert Storm, Operation Sea Angel and operations in Somalia has earned it an outstanding reputation for reliability and overall capability.

Lieutenant General Boomer, the Marine Component Commander during DESERT SHIELD and DESERT STORM, summed it up best, "How did the LCAC perform during Desert Storm? In a word, superbly. They performed with 100 percent reliability. Marines came away from that campaign feeling that our cost and time invested in the landing craft air cushion had been truly vindicated."[13] Major General Jenkins, the commander of the 4th Marine Expeditionary Brigade during the same period, said the following about the LCAC: "We used it during day and night transport, for the assault echelon, for logistics, for raids -- it came into its own during our operations in the Persian Gulf region. We didn't have to land in Kuwait because our presence and our capability to strike at a wide choice of locations, at a time of our choosing, fixed Iraqi forces along the coast enabling I MEF to destroy them from the rear."[14]

In Bangladesh, during Operation Sea Angel, operating conditions were extremely difficult. Shallow tributaries, extremely high tides, and strong currents made conventional landing craft almost useless, but not the LCAC. Four LCAC handled the bulk distribution of food and medical supplies to the devastated area, delivering 1526 tons to the outlying areas.[15]

LCU Capabilities and Limitations: Long considered the work horse of amphibious operations, the LCU has long provided the heavy lift requirements for ship-to-shore maneuver. With its 180 ton lift capability, it has carried everything from three tanks to hundreds of troops in exercises and operations for over three decades. However, the LCU have only a limited ability to employ tactical surprise, for three basic reasons. First, they are restricted to those beaches that are hydrographically suitable for landing -- this limitation also applies to amphibious assault vehicles (AAVs) and mechanized craft (LCM-8s). This restriction helps the enemy commander identify the most likely avenues of approach and plan defenses to counter the assault. In effect it allows

the enemy command and control element to identify a potential critical vulnerability for exploitation against friendly forces. Second, the slow moving assault craft must be launched relatively close to the beach to simplify their navigation for control purposes, minimize transit time to the boat lanes, and as a matter of general safety. This requirement alone precludes achieving the element of surprise. At a minimum, two to four hours will elapse from the initial appearance of the amphibious task force on the horizon until the landing of the first units at H-hour. The third limit is the predictability of any large-scale assault. Ports and airfields near the coastline have been almost mandatory objectives of the assault force, allowing the enemy commander to predict with a fair degree of certainty which area to strongly defend.

Future LCAC Enhancements. Developments for the future use of LCAC have already begun. In addition to various logistics concepts of employment, four areas of enhancement currently being considered concern: mine warfare, increased troop lift capability, patrol boat or anti-aircraft picket boat, and Forward Arming Refueling Point.

- Mine warfare. Previous methods to clear mines from a landing area have included the use of Sea-Air-Land (SEAL) teams and mine sweep ships. Both options have denied the element of surprise to the landing forces. To ensure access to a mined landing beach or coastal approach while preserving tactical surprise, a method of rapid shallow-water mine clearance is required, one that essentially plows a cleared lane through the surf zone and any suspected land mines on the beach. Potential means include line charges, naval gunfire, or air strikes. LCAC testing to support this effort has included launching weighted line charges from the leading LCAC as they approach the beach. The line charge falls across the mined area and detonates the mines before assault waves pass through. A second method of mine clearance is the towed sled currently used

by MH-53E helicopter squadrons. Modular mine counter-measures deployment packages have been acquired and successfully tested with the LCAC.[16] However, the cost of this second option for mine clearance by LCAC has proved as costly as deploying either conventional surface or aviation mine sweep assets. Therefore, the probability of further development and deployment of the mine countermeasures deployment package is doubtful.[17]

- Personnel Transport Module (PTM). The LCAC, until recently, has only had the capability of transporting 24 combat personnel. The development of the PTM provides it with the capability to transport an additional 180 combat troops -- a monumental increase in personnel lift assets. This portable module can be assembled by 12 personnel in less than four hours without the need of a crane or forklift. It has forced ventilation, lighting, an interior voice communication unit which allows an embarked troop commander to communicate with either the LCAC Officer-in-Charge (OIC) regarding beach penetration or to higher authority through the craft OIC. In a non-combatant evacuation operation or medical evacuation it can carry 205 ambulatory personnel or 108 medical litters. This capability greatly expands LCAC use beyond carrying heavy rolling stock: tanks, artillery pieces, light armored vehicles (LAV), and tracked personnel landing vehicles.

- Patrol boat, antiaircraft picket boat. Armed with the M-60 and .50 caliber machine guns, the LCAC would be manned by Navy personnel operating inside the Amphibious Operating Area (AOA). For the antiaircraft mission, crews would be armed with Stinger missiles. As long as communications can be maintained with parent units or warfare commanders, the LCAC has the ability to operate over-the-horizon, independently in support of the Amphibious Ready Group (ARG) defense.

- Forward Arming and Refueling Point (FARP). This concept uses the LCAC defueling capability to refuel AH-l Cobra helicopters being used in support of LCAC operations. The LCAC ability to conduct long-range assaults and raids by sea complements the helicopter's ability to conduct such operations by air. However, the LCAC requires armed escorts in a hostile environment. The problem is the escort helicopters do not have the on-station endurance of LCAC. What Marine aviation has proposed is a FARP that can be established, operated, and displaced quickly, while reducing the risk of detection by the enemy. One solution is to use the LCAC as a mobile FARP. It can carry the raiding force and simultaneously meet all FARP requirements. It has the capability of internally defueling 250 gallons per minute. Its fuel tanks hold 5000 gallons of JP-5, the same fuel used by helicopters. It can refuel escort aircraft from its internal tanks, eliminating the requirement to displace cargo with fuel bladders. The 5000 gallons of fuel is more than enough for the LCAC to complete a mission and still provide the normal 313 gallons per aircraft required for helicopter escorts, thereby extending helicopter on-station time in support of advanced, raiding, or reconaissance forces.[18]

Future LCU Enhancements. Due to their age, there are no enhancements planned for the current inventory of LCU. Because of their design and steel construction, the feasibility of increasing their speed is extremely limited. The costs would greatly exceed the gains achieved. To apply gas turbine technology would require a new, lighter design, which, based on current research and acquisition processes, would mean delivery to the fleet sometime around the year 2010. However, a gas turbine propelled LCU would still not be as versatile as the LCAC. It still would be limited by the same factors that affect the current inventory of LCU -- beach hydrography and surf conditions.

Why Consider LCAC Retirement?

The facts seem to point toward a greater utilization of the LCAC instead of less. Why then consider retirement of the newer LCAC technology and enhancement of the older LCU technology? Although not advocating LCAC retirement, Lieutenant General Boomer stated the following when discussing future defense spending and force structure, "One thing is clear in the debate at this point: the forces we retain will be smaller; they must be highly capable and relevant to the new world order; they must be useful over a wide spectrum of contingencies; and finally they must be affordable."[19]

The LCAC was developed during an era of defense build-up -- a period when the United States faced a vastly different national threat. We have entered a new era of naval warfare and face a multitude of uncertrain threats, primarily in the low to mid-intensity areas of the spectrum of conflict. Additionally, this new era encompasses the arena of peace-keeping operations and humanitarian assistance, which offer greater opportunity for unopposed entry versus the conventional opposed entry associated with high-intensity conflict and amphibious assaults. Such a shift in concept of operations could be argued as reducing the requirement for speed, over-the-horizon approach, and increased beach access provided by the LCAC.

A second reason for considering LCAC retirement is the continuing emphasis on reducing defense spending. The average cost per unit of the LCAC was $27 million. By 1997 the U.S. Navy will have 90 units in its inventory for a total cost of over $2.4 billion. The annual cost per unit of the LCAC is estimated at $1 million for a total annual cost of $90 million. The newest LCU is ten years old; the first one entered service in 1959. Out of 55 craft built, only 34 remain in amphibious service and continue to provide outstanding support to amphibious

operations. The annual cost per unit of the LCU is estimated at $25 thousand, for a total annual cost of $850 thousand. Simple math shows a potential savings of $89 million per year if LCAC are retired from service.

Compounding the debate is the fact that the total number of amphibious ships is down from a high of 67 ships in the mid-1980s to 36 ships in 1995. Half of the ships in the 1980s were not capable of carrying either the LCAC or the LCU; today's inventory of amphibious ships is capable of carrying one or both of the craft. However, with the decommissioning of the LST-1189 class of ships, the dedicated asset for carrying the AAV tracked vehicles has also been lost. These assault wave units will now be competing for deck space against the LCAC and LCU. This also means that now a well deck asset from the ARG will have to maneuver closer to the shoreline in order to launch the AAV. This requirement will place a significant multi-purpose asset, normally one third of the ARG, within enemy shore defense range.

What can be gained by retiring the LCAC?

The gains that can be achieved by retiring LCAC and returning to use of the LCU as the primary landing craft fall into three categories: cargo/personnel lift, range, and reduced costs.

The LCU has the capability to lift 180 tons of cargo while the LCAC is rated at 60 tons (75 tons overload rate). The thirty-four LCU have a total lift capacity of 6120 tons of cargo. Ninety LCAC have a total regular lift capacity of 5400 tons; at the rated overload capacity the total lift capacity increases to 7650 tons. The LCU has approximately 1000 more square feet of deck cargo space over the LCAC (2880 compared to 1910 square feet). The LCU can each carry 400 combat loaded troops, albeit for short distances. The LCAC can regularly carry 24 combat loaded troops. With the Personnel Transport Module (PTM) installed, it can carry an additional

180 combat loaded troops. One LCU therefore has a 15:1 troop lift advantage as compared to the LCAC without the PTM, or a 2:1 troop lift advantage if the LCAC has the PTM installed. The 34 LCU can do as much, if not more, than 90 LCAC.

Second, although the over-the-horizon capability is not feasible with the slower 11 knot speed of the LCU, it does have a range of 1200 miles; a 6:1 advantage over the 200 mile range of the LCAC. This greater range capabilty, coupled with its heavy lift capability, could prove advantageous in providing an alternative to less useable Host nation transportation networks. Moving cargo more than 200 miles by LCAC would require the establishment of an intermediate refueling point, although cargo could be moved up to four times faster than by LCU. For distances less than 200 miles, it would simply be a decision of time or speed of delivery. That decision would be situation dependent based on the type of mission or level of intensity of the conflict. Although capable of operating in sea state three, like the LCAC, the LCU would have to remain closer to the beach due to the risks.

The third argument for LCAC retirement and a resurgence of LCU utilization is cost. As pointed out above, the Department of the Navy could save over $89 million a year in maintenance and operating costs by retiring the LCAC. Diesel technology is much simpler and cheaper to maintain compared to the LCAC gas turbine engine system. Operationally, while it requires a crew twice the size of the LCAC, the cargo lift and extended range capabilities of just one LCU offset the cost in manpower. While the unit cost of the LCU is not known, based on its diesel technology, it was no where near the $27 million price tag of the LCAC. The money saved by retiring the LCAC could keep the LCU program operating for decades.

What capabilities are lost by retiring the LCAC?

A program that retires the LCAC results in three significant losses, with a number of variables, for the amphibious forces. First is the financial loss. The Department of the Navy has invested nearly $2.5 billion in construction costs for the fleet of 90 craft already delivered or scheduled for delivery in the next 18 months. The simple fact is the LCAC is one leg of the new technology for surface amphibious maneuver. The production of all but the last two LCU was spread out over 16 years, beginning 36 years ago. Over 70 percent of the inventory is over 25 years old. Many of the craft are near the end or have exceeded their planned lifespan. Because of the long production period, their unit cost is difficult to determine. While their replacement cost, as currently configured, should be considerably less, any plan of replacement with enhanced LCU would require significant research, development, and increased operational costs. The LCAC technology is already here; the units only need to be maintained.

There is also the financial cost associated with manpower. The LCAC has five crewmembers; the LCU has ten crewmembers. Using as a basis a fleet of 90 LCAC and 34 LCU, this equates to 450 personnel for the LCAC operations and 340 personnel for the LCU operations. However, as mentioned earlier, the LCU also requires a significant personnel drain on the amphibious shipping assets. Each ship requires 30 personnel assigned to the Condition 1A watchbill for linehandling operations associated with the LCU. That is an additional 1080 shipboard personnel. The LCAC requires four ship's crewmembers to support LCAC operations for a total of 144 personnel throughout the amphibious fleet. The bottom line is that the total number of personnel required to support LCU operations is more than double the requirements of the LCAC.

A second significant loss is the element of surprise. The LCAC provides the capability of

conducting high speed operations from over-the-horizon against 80 percent of the world's beaches. The stringent requirements of beach topography -- gradient, wind, current, surf height, and the onshore area -- limit conventional landing craft to the use of only 20 percent of the world's beaches. The traditional amphibious assault H-Hour usually occurred two to four hours after the ATF sailed over the horizon into the Amphibious Operating Area (AOA). In contrast, the OTH capability of the LCAC, when coupled with the conventional approach that would still be required to get the AAV ashore means the elapsed time from the first appearance of the ATF on the horizon until H-Hour is significantly reduced -- 30 minutes versus the minimum two hours.[20] With LCAC, the ATF commanders can choose the time and place for putting troops and equipment over the beach. For unopposed landings, this is not an issue, but not all conflicts or missions will provide total freedom of movement into the area of operations.

The third significant loss is flexibility. With its ability to maneuver on the beach, the LCAC can move ashore, turn around to the direction best suited to offload, and then debark its cargo. With its fore and aft ramps, equipment can drive in and drive off the LCAC; the landing force equipment does not have to be specially placed in order to back into the cargo area as is the case with the LCU. The ability to maneuver on the beach also saves wear and tear on the landing force equipment since it does not have to drive through the surf zone, suffering the detrimental effects of saltwater. The LCAC ability to position anywhere on the beach, as opposed to the confines of the designated beach lanes, also reduces the congestion associated with establishing a beachhead. As to vulnerability near the beach, the fact that the LCAC rides on a cushion of air, coupled with its speed and maneuverability, provides the landing force as great a degree, if not greater, of flexibility and survivability. It is hard to believe that a conventional landing craft or

amphibious personnel carrier waddling into a limited beachfront at five to ten knots is less vulnerable than a 40 knot LCAC. Additionally, the LCAC can be refueled while being loaded. The LCU will refuel either alongside an assigned ship or in the welldeck; in either case, loading must stop until refueling is complete. And finally, ships conducting LCAC operations can simultaneously conduct flight operations. Ships operating with LCU must delay or secure flight operations while conducting wet well operations. At a minimum, this is a loss of two hours -- 30 minutes to ballast down and receive the LCU, up to 60 minutes to load the LCU, and another 30 minutes to debark the LCU and deballast.

CONCLUSION. The LCAC lift capacity, coupled with its speed and maneuverability, provides a mobility package that gives even more speed and power to the Marine-Air-Ground Task Force's (MAGTF) punch. It promises to keep the MAGTF at the center of the military's power projection mission well into the 21st century. When you combine the LCAC with the AAAV and V-22, "you put at risk just about any hunk of littoral anywhere around the world."[21]

Together, the LCAC and LCU represent a potent force and cargo moving capability of the amphibious forces. There is a need to retain the individual capabilities of each craft. The LCAC is ideally suited to put forces ashore when and where the ATF commanders want within the concepts of OMFTS and can reach coastal areas that need supplies but are inaccessible to conventional landing craft. Although slower, the LCU can carry more cargo; its only real limitation is depth of water. As long as beach gradients support their landing, LCU have a position in the assault echelons, while LCAC either cross the beach through secured zones or transport forces in an envelopment maneuver. For peacekeeping, civil emergency, and humanitarian operations, where the ATF can maneuver closer to the beach, the LCAC can

provide depth and speed in maneuvering to remote areas, and the LCU can provide heavy lift via supporting beaches or port facilities. The one thing the LCU can not do, regardless of enhancement packages developed, is replace the speed and mobility capabilities of the LCAC. The investment in LCAC has been made; they have proven their value to today's naval expeditionary forces. Despite the heavy cost in maintaining and operating LCAC, now is not the time to be considering retirement. Power projection, a key function of "FORWARD...From the Sea," is where the LCAC has made, and will continue to make, the doctrine to prepare the naval service for the 21st century a reality.

NOTES

[1] CDR Robert H. Howe, USN, "Tomorrow's Gator Navy" Naval Institute Proceedings 114, no.12 (December 1988): 63.

[2] Department of the Navy, FORWARD...From the Sea, (1994): i.

[3] Howe, 64.

[4] Howe, 65-66.

[5] Howe, 66.

[6] CDR Christopher M. Wode, USN, "Operational Maneuver '...From the Sea"' Amphibious Warfare Review 12, no.2 (Summer/Fall 1994): 35-36.

[7] Wode, 35.

[8] Major Jon T. Hoffman, USMCR, "The Future Is Now" Naval Institute Proceedings 121, no.11 (November 1995): 32.

[9] LCDR T. J. McKearney, USN, "Launching the New Assault Wave" Naval Institute Proceedings 113, no.1 1(November 1987): 45. All ships in the U.S. Navy operate in one of five readiness conditions which incorporate different levels of manning being on-station and weapon systems being online for the defense of the ship. Condition 1 is the highest state of readiness with both 100 percent manning and 100 percent of the weapon systems on-line. Within Condition 1, there are subcategories of readiness which allow a ship with a unique mission to remain at a lesser state of readiness (roughly 70 percent manning and weapons systems) while conducting that mission. For ships with a welldeck, this subcategory is known as Condition 1-A.

[10] McKearney, 46.

[11] LCDR David H. Smith, USN, "New Speed for the Spearhead" Naval Institute Proceedings 113, no.11 (November 1987): 49.

[12] McKearney, 47.

[13] Lt Gen Walter E. Boomer, USMC, "High Performance Craft in U. S. Marine Operations" Amphibious Warfare Review l0, no.2 (Summer/Fall 1992): 7.

[14] Amphibious Warfare Review Staff, "Maneuver Warfare From the Sea -- Honing the Fighting Edge" Amphibious Warfare Review 9, no.1 (Winter/Spring 1992): 14. This is an AWR Staff article written based on an interview with Major General Harry W. Jenkins, Jr., USMC.

[15] Boomer, 7.

[16] Glenn W. Goodman, Jr., "Breaching Unseen Bafflers: Offshore Mines Remain the Achilles' Heel of U. S. Naval Expeditionary Forces" Armed Forces Journal International 133, no.4 (November 1995): 41.

[17] CAPT Bruce Vanbelle, USN, Director, U. S. Department of the Navy Expeditionary Warfare Division (OPNAV N-852), 1996, interview by author, 01 March 1996.

[18] Capt 13. C. Lindberg, USMC, "The LCAC as a Forward Arming and Refueling Point" Naval Institute Proceedings 115, no.11 (November 1989): 104,

[19] Boomer, 5.

[20] Smith, 49.

[21] John G. Roos, "Shaking Up America's Force of Choice" Mined Forces Journal International 133**,** no.6 (January 1996): 21. This is a statement made by General Charles C. Krulak, Commandant, U. S. Marine Corps, during an interview for AFJI, in which he assessed the implications of several changes now underway in the USMC, and provided his vision of the future.

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